Automated PCR Program

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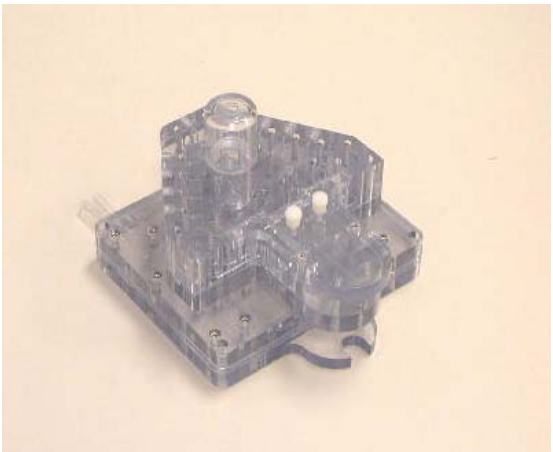
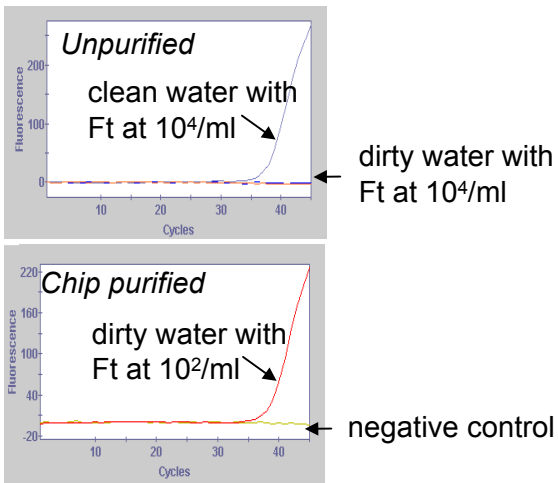
Project Summary

Rapid, sensitive, autonomous detection of airborne pathogens is critical for military and civilian biodefense. Microfluidic Systems, Inc. (MFSI) has teamed with Lawrence Livermore National Laboratory to build a completely integrated microfluidic instrument to monitor the air for genetic signatures of pathogenic agents. Genetic testing offers high sensitivity to maximize the probability of detection and high specificity to minimize the probability of false positives. The instrument, called the Rapid, Autonomous, Integrated DNA/RNA Detection System (RAIDDS), utilizes reusable, three-dimensional, microfluidic circuitry to integrate and automate air collection, sample processing, and parallel PCR detection. RAIDDS is designed to monitor the air for 10 pathogenic agents, exhibit a limit of detection of one agent per liter of air, and run unattended for days.



This plastic block is an example of the core 3-D microfluidic circuitry that will be utilized in RAIDDS. Over 20 valves are embedded in this block. The RAIDDS cassette (block) will contain over 80 valves. Circuits will be tailored to replace many complex pipetting tasks such as aspiration, dispensing, aliquoting, and mixing.



Air collectors can contain a high background of material that can inhibit PCR. These PCR results demonstrate how the RAIDDS nucleic acid chip can recover and concentrate *Francisella tularensis* (Ft) DNA from 12 ml of dirty water. Ft DNA in dirty water was undetectable before chip processing. Processing removed inhibitors and concentrated the DNA by a factor of 100 (similar PCR signals were obtained for the chip-purified Ft DNA at 10^2/ml in dirty water and unpurified Ft DNA at 10^4/ml in clean water).